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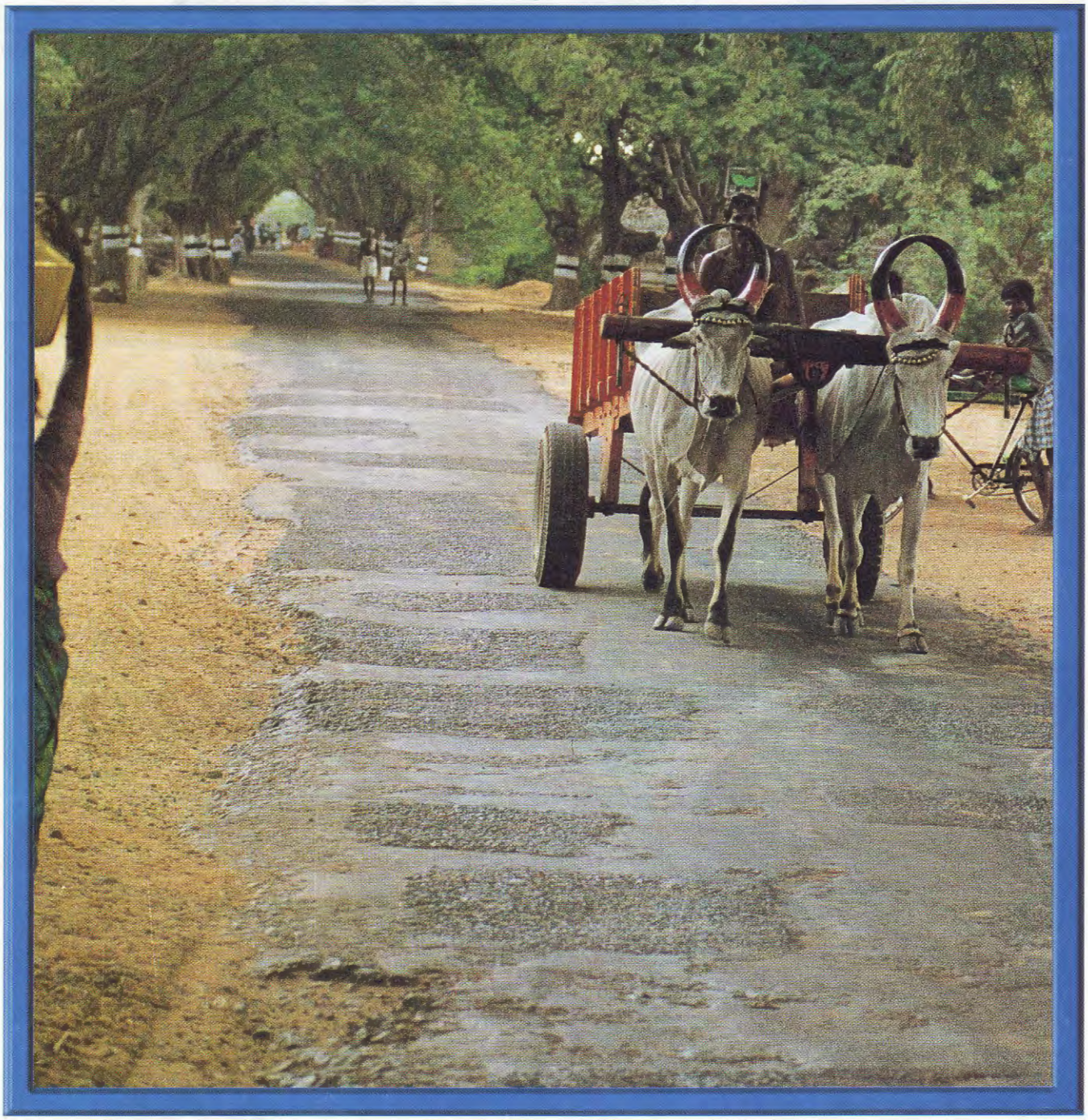

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JOURNAL

EDITORIAL INTRODUCTION

One of the key goals of REAAA is technology transfer. This Journal is one of our tools to achieve this goal. Another is the conduct of seminars, workshops and conferences where knowledge is transferred face to face.

In June 1999 REAAA planned to hold a "Senior Management Seminar on Road Management" to discuss the experiences of road administrations in a time of massive change in the way roads are managed and the performance of administrations measured. Unfortunately, the seminar had to be cancelled at the last moment. The economic difficulties being faced by many nations in the region meant that few government officials were able to travel to Bangkok. REAAA expresses its gratitude to Transit New Zealand and to the Roads Association of Thailand, which had worked tirelessly to plan the event. At a more personal level thanks are due especially to Fiona Knight and to Anant Vongphanich. Thanks are also due to the people who had agreed to be speakers and who had undertaken much preparatory work.

Three of the papers prepared for this seminar had been completed at the time the event was cancelled. They are published in this issue of the Journal as important contributions to this critical topic of the management of roads. The papers have been left essentially in the form of "presentations" rather than conventional journal articles, the editing has been restricted to that necessary to enable them to stand alone from their intended visual aids.

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Cover photo is on State Highway near Kumbakonam, Central Tamil Nadu State, India.

How Roads Are Managed - An Australian Case Study

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VicRoads, Australia

Introduction

This case study of how roads are managed in Australia considers the broader economic, political social and technological forces impacting on road managers. In addition, the case study also considers the impact of certain discrete events, sometimes occurring in response to these broader forces and sometimes occurring for other reasons. The case study aims to place these events in an historical context, considering in broad terms what we have achieved to date in road management and some possible future directions.

As Australia is a Federation, and road management has been principally the responsibility of State Governments, the State of Victoria has, where appropriate, been used as a more specific case study.

Context

Geographical Context

Australia is an island continent with a land area of 7.7 million square kilometres, and a population of 18.75 million. The majority (over 55%) of the population is concentrated on the narrow coastal strip in south east Australia along a 2000 km length, including the major metropolitan areas of Sydney, Melbourne and Brisbane.

Geologically, Australia is an old continent. Australia's topography has not presented Australia's road managers with the types of engineering challenges requiring extensive bridgeworks and tunnelling faced in some other countries. Australia is also fortunate in being relatively stable geologically, experiencing relatively few earthquakes and having no active volcanoes.

Climatically, Australia varies from tropical in the far north to cool temperate in the south. Its higher mountains are snow-covered in winter, but are not above the permanent snow line. The most adverse natural phenomena faced by Australia's road managers are flooding, violent storms and bushfire.

Table 1 and figures 1-3 compare a number of key statistics between countries. It is clear that Australia has a more extensive road system relative to vehicle numbers than that of other countries. Australia also has higher levels of travel per vehicle and higher levels of vehicle ownership than European countries, but less than the United States.

The large land area, and distances between population centres has had an important bearing on our road technology – particularly flexible pavements and chip sealing.

Political Context

Australia is a Federation, comprising a national (Commonwealth) Government, six State and two Territory Governments. Under Australia's constitution, adopted at the time of Federation in 1901, the

Table 1
Selected comparisons between Australia and other countries
1996

Country	Area (sq.km)	Population (000)	Population Per sq.km	Road km per 1000 cars	GNP per capita $US	% GNP on roads
Australia	7,682,300	18,750	2.4	104	18,400	1.20
U.S.A	9,052,871	265,557	28.4	49	25,300	1.00
Canada	9,203,210	29,995	3.0	not available	19,400	0.50
U. K.	229,880	58,782	240.0	22	17,000	1.20
Germany	356,854	81,877	229.4	19	17,800	0.50

Source: OECD

Figure 1: Paved road network length – international comparisons

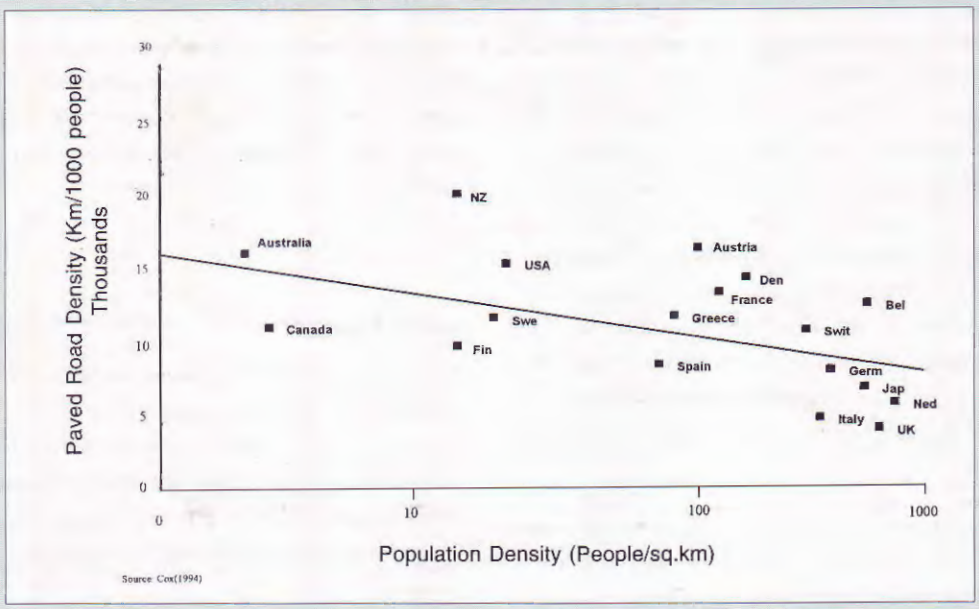
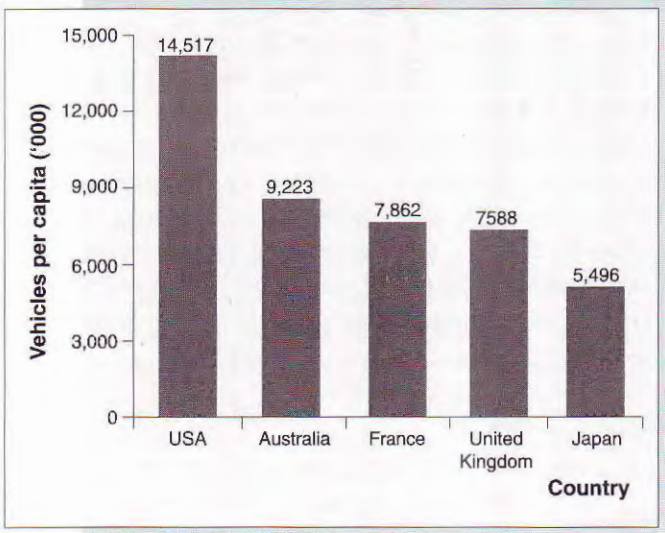


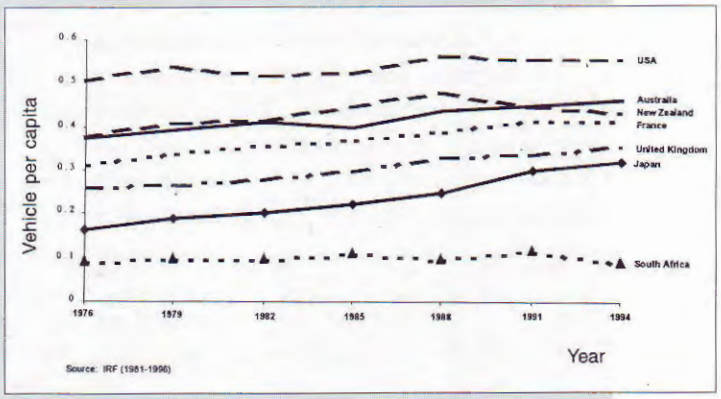
Figure 2: Vehicle travel per capita – international comparisons



Source: *IRF (1996); ABS Catalogue nos. 3201.0 and 9202.0*

Note: *These figures should not be read as indicating the average distence travelled per person as they include both freight and passenger vehicles and also do not allow for the number of occupants per vehicle.*

Figure 3: International passenger vehicle ownership comparisons



Commonwealth Parliament only has legislative jurisdiction on matters named in the Constitution. The States and Territories have legislative power in other matters. Over time, the Commonwealth has extended its influence over matters previously the exclusive jurisdiction of the States. It has achieved this through a number of means, including the use of its financial influence, its powers in relation to interstate trade, the passage of several referenda, through certain decisions of the High Court, and through agreement with some or all of the States. Historically, the Commonwealth has had much greater revenue raising powers, while the States have had more significant spending responsibilities, resulting in a situation described as 'vertical fiscal imbalance'.

In the case of roads, the Commonwealth Government fully funds improvements and maintenance works on a National Highways system which links all mainland State capital cities and certain other centres. The Commonwealth Government also funds, on a 50% basis with the States, designated "Roads of National Importance" and road accident "Blackspot" programs.

State and Territory Governments have typically had responsibility for the funding and, in some cases, the management of arterial roads. Australia's third tier of Government, Local Government, is established under State laws. Local Government typically has responsibility for the funding and management of local roads. In some States, Local Government also has responsibility for the management of certain arterial roads, funded by State Governments. In certain States, with remote regions, not serviced by Local Government, the State Government has responsibility for Local Roads.

Under Australia's democratic system of government, Governments of varying political persuasions are elected, with differing priorities in terms of road management. Some Governments have favoured increased freeway development. Others have favoured a traffic management focus with a larger emphasis on improving public transport. Latterly, Governments have adopted a more middle course with emphasis on developing more limited, but linked freeway networks servicing major airports, seaports and industrial areas and linking these to the rural freeway networks to lower the costs of transporting goods. Better management of existing assets through traffic management approaches has been supported by all Governments.

Increased emphasis has been placed on improved environmental standards of major roads to meet increased community expectations.

In recognition of the need to enhance national economic performance, the Commonwealth and States have recognised that Australia can no longer afford the luxury of individual States and Territories going their own way on issues of national significance. To lower transport costs further, it is imperative that there be consistency between State rules and regulations. It is also vital that we pursue improved national standards such as increased vehicle mass limits.

As a result, the following decision making and advisory bodies have been established to co-ordinate the development and implementation of policies (Refer Fig. 4). While bodies such as the Ministerial Council for Road Transport attempt to reach agreement between the Commonwealth and States, they do have voting mechanisms available to overcome minority disagreement should this be necessary.

Social Context

Australia has had a growing population for many decades and now has a population of 18.75 million. Following World War 2, Australia has fostered an immigration program that has welcomed people from many nations. Over recent years, the level of migration has reduced and, consequently, population growth has slowed.

Despite its large land area, Australia is a highly urbanised society. 62% of the population live in the six state capital cities. Indeed 39% of the population live in Australia's two largest cities, Sydney and Melbourne. Though not large in population on a world scale, Australia's major cities are large in area due to low population densities, assisted by Australia's comparatively low land prices. This low density of urban development, accompanied by a suburbanisation of jobs has encouraged high levels of vehicle ownership and use, and associated lower levels of public transport usage (Refer Fig. 5).

Figure 4: National Transport Bodies

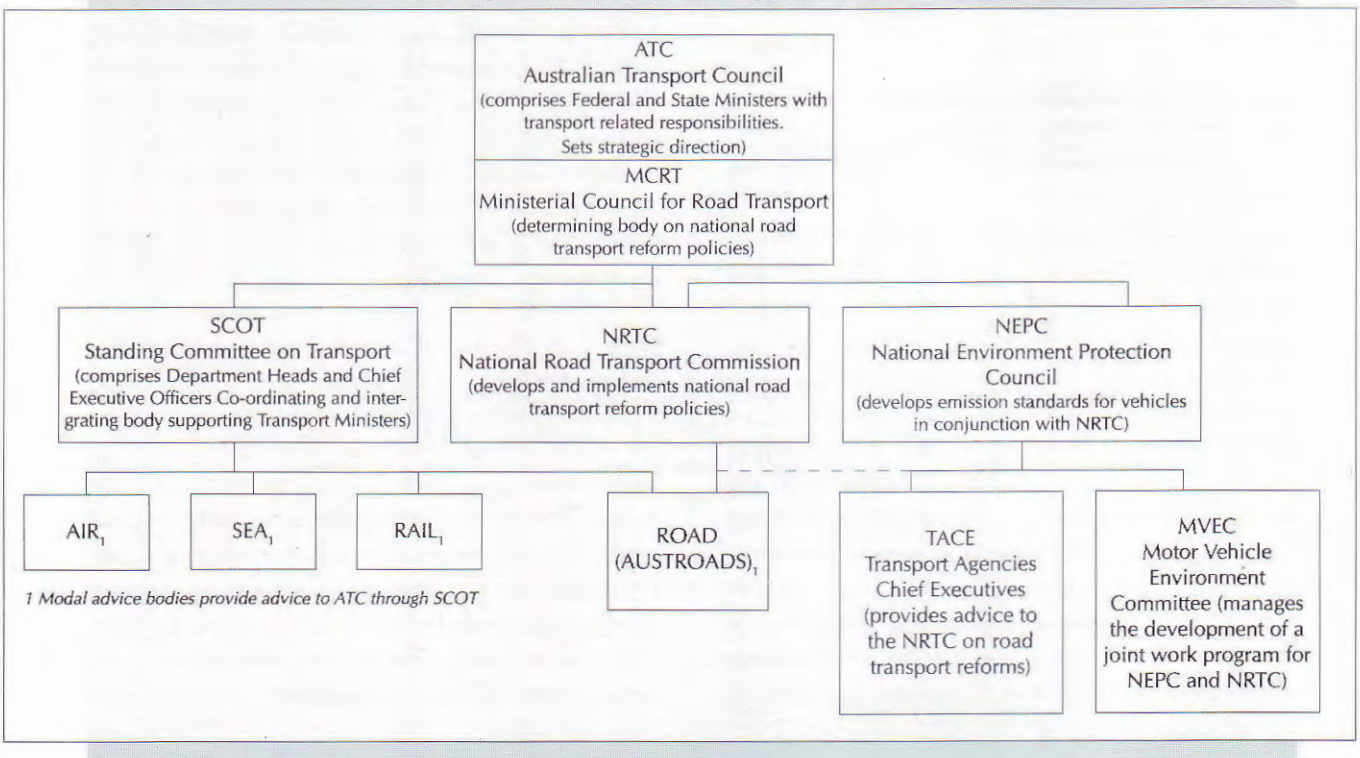
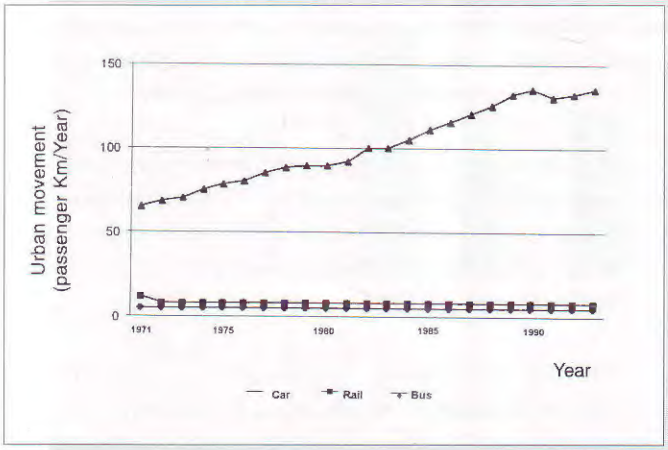


Figure 5: Australian trends in urban passenger travel



Economic Context

Australia traditionally had an economy based around mining and primary production. These two sectors still account for a large proportion of Australia's foreign trade. Around 1900, based on wealth generated from mining and primary production, it was estimated that Australians enjoyed the highest per capita income in the world.

After World War 2, Australia encouraged the development of manufacturing industry, protected by high tariff barriers and quotas. However, by the early 1980's, it was realised that Australia's relative economic position in the world was slipping and that action needed to be taken to encourage higher sustainable rates of economic growth if Australia was to continue to prosper.

As a consequence, during the 1980's and 1990's, the Commonwealth Government sought to increase competitive forces within the Australian economy as the strategy to seek faster rates of long-term economic growth. It undertook measures such as floating the currency, allowing the entry of foreign-owned banks and reducing tariff protection for Australia's protected manufacturing industries. It has also reduced the influence of centralised wage setting tribunals and moved towards Enterprise level negotiation of wages and conditions.

These policy changes aimed at forcing the Australian economy to become more internationally competitive. These changes had a flow-on effect for other sectors of Australia's economy, including Australia's domestic infrastructure providers in transport (road, rail, airports, seaports) as well as electricity, gas and water. Commonwealth agencies such as the Bureau of Industry Economics, and Industry Commission as well as coalitions of business such as the Business Council of Australia became interested in the performance of Australia's infrastructure providers. The reasoning was simple – if Australian industry had to face increased foreign competition, then infrastructure providers whose costs and service levels impacted on industry's costs should also become more competitive.

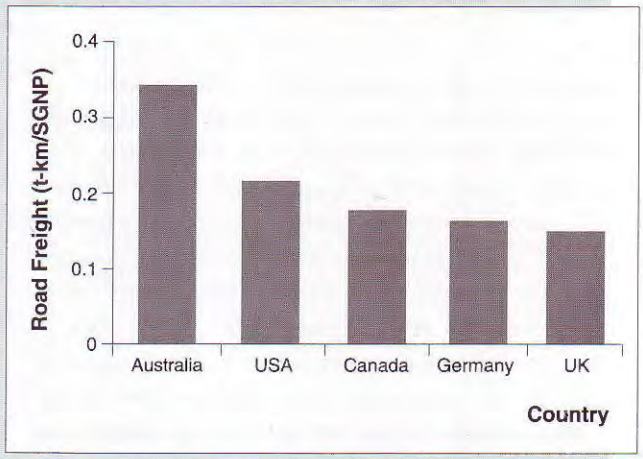
The Commonwealth Government in partnership with the states developed a "National Competition Policy".

This policy requires State Governments to:

- review all legislation for an anticompetitive elements
- establish third party access regimes to essential infrastructure facilities
- review structural arrangements for Government monopolies
- ensure Government service provision is placed on a competitively neutral basis with the private sector
- ensure Government agencies comply with the Trade Practices Act
- ensure prices oversight of Government Business Enterprises
- implement specific other reforms, designed to enhance the competitiveness of the Australian economy.

As mentioned previously, given the importance of road freight to the National economy (refer Fig. 6), the Commonwealth and State Governments, have been implementing a co-ordinated program of national road transport reform. It has been recognised that road management needs to take a much more national approach so that road users have a common set of rules and systems for vehicles, drivers, loads, and road use. Key elements of the reforms have or will include:

Figure 6: The importance of road freight to the Australian Eeconomy



Note: GDP is in purchasing power parity values
Source: John Mc Lean (personal communication)

- uniform mass and dimension limits, and registration charges
- uniform road laws across Australia
- national road safety initiatives (eg. driving hours, dangerous goods, national driver licences, speeding)
- national exchange of vehicle and driver information
- uniform enforcement/ alternative compliance programs
- introduction of higher productivity B-double trucks
- increase in allowable mass limits for B-double trucks and semitrailers

The Commonwealth and State Governments have signed a 'Competition Principles Agreement' Under this agreement, the Commonwealth Government has agreed to make substantial payments if the States implement agreed reforms within agreed timeframes. Australia has therefore institutionalised a powerful mechanism to encourage the implementation of economic reforms such as those in road freight.

Technological Context

Following the extensive development of railways in Australia, which occurred principally between 1854 and 1900, the role of roads took a second place in comparison with the role of railways. Roads tended to play a secondary role as feeders to railways.

With the ongoing development of the internal combustion engine, pressure has grown for improvements to roads.

Australia's governments have not sought to restrict or regulate motor vehicle ownership through very high cost registration fees or fuel taxes, as occurs in some jurisdictions.

Australia, with its relatively mild climate, does not have to use salt to remove snow from roads. Cars are therefore not subject to corrosive attack from such practices. The Australian motor vehicle fleet is therefore relatively old, which results in fleet-wide changes through the use of design rules to for example, enhance safety or improve environmental performance, taking longer to have an effect than would be the case in other countries. Basic motor vehicles are thus relatively cheap to own and operate. As noted elsewhere, motor vehicle ownership levels are very high compared with many other countries despite our relatively lower standard of living.

While Australia was slower than some other countries in developing interconnected freeway networks around its cities, Australian road agencies were early adopters of computer and microprocessor control technologies for use in controlling traffic on arterial roads.

They have continued this path with developments such as the Motorway Management System which provides functions including real time advice to motorists of travel times using variable message signs, and median barrier control.

The use of electronic identification tags for toll collection purposes is now being introduced by the private sector. Road agencies are therefore putting in place technology platforms that offer a range of opportunities for value adding service providers in the private sector. Building upon the availability of this technology, road agencies will be able to electronically monitor and report travel times over a much greater road network than is possible under current arrangements.

The use of Global Positioning Systems (GPS) technology for monitoring of heavy vehicle movements is being trialed in one State. This Technology has a range of potential applications.

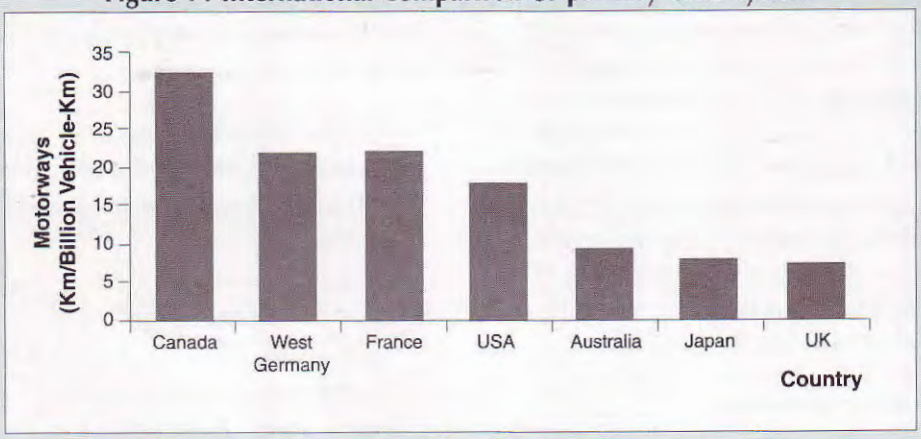
There have been considerable developments in truck capabilities. In recent years, B-double trucks with Gross Combination Mass of 65 tonnes have been permitted. In certain very limited applications, B-triple trucks (3 linked trailers behind a prime mover) and Super B-double trucks (110 tonnes Gross Combination Mass) have been permitted. For example, Super B-double trucks operate between the interstate rail terminal and international container port of one major State Capital city. Road trains with multiple trailers operate in outback areas of Australia.

Changing approaches to manufacturing and company logistics management has seen further pressure for change for commercial vehicle operators. Just-in-time manufacturing processes favour the use of small loads in trucks rather than larger loads delivered by train. Company rationalisation has resulted in truck deliveries being required in pre-determined time slots to minimise staff in loading bays. This has increased pressure for more reliable travel times.

Road System Context

Australia's road network would largely be described as "mature". All significant population centres are now linked by sealed road. However, major population centres and rural areas do not have the extensive linked

Figure 7: International comparison of primary road system



freeway networks that are in place in the United States and Europe that enable higher speed and safer long distance travel and provide shorter travel times between areas of economic significance. (Refer Fig. 7) Urban development has proceeded more rapidly in some cities than the rate of arterial road upgrading. In rural areas, horizontal and vertical alignments and carriageway widths are, in some regions, below currently acceptable standards from a safety perspective.

In addition, the Australian road network more generally is considered to be "lightly constructed". It is technically feasible for trucks to be built to carry much heavier loads than the road network is currently able to cater for.

In 1995/96, expenditure on Australian arterial road construction and maintenance was an estimated $4.2 billion. Construction activities accounted for 64% of this expenditure and maintenance activities accounted for 36%.

At a State level, it has been recognised that road management needs to be undertaken within a broader context of economic development, land use and transport planning.

Australian road agencies typically focus on achieving outcomes that:

- contribute to economic, social and regional development
- improve traffic flow
- enhance safety
- minimise adverse environmental effects of roads and road traffic.

To better achieve these outcomes, current emphases in road management are:

- Increasing standards of the road networks in metropolitan and rural areas to provide higher speed and safer roads to enhance urban and regional development. Melbourne, Sydney and Brisbane have further major extensions to their freeway networks underway or planned. Many of these major road network extensions have focused on improving access to facilities of national and international significance including international airports and seaports. Improved transport systems are seen as one building block in enhancing regional attractiveness and competitiveness in the emerging knowledge based, global economy. Further upgrading of major rural highways to provide divided freeway standard is also underway or planned in corridors of national significance.
- Better integrating road planning with other transport planning and with land use planning.
- Increasing the ability of the road network to cater for heavier loads.
- Continuing development of arterial roads in outer suburban areas to "catch up" with urban development
- Upgrading of unsealed roads to provide sealed conditions to settlements not currently connected to the sealed network
- Better managing existing roads through improved traffic management, including the use of Intelligent Transport Systems.
- Improving networks and travel times for road-based public transport.
- Better managing road use through uniform national laws and through reduced bureaucratic control
- Enhancing road safety through integrated programs targeting identified problems with vehicles, drivers, roads and other road users including pedestrians

- Introducing higher standards of environmental performance
- Strategic approaches to asset management

Case Study: Road management in the State of Victoria

VicRoads manages a network comprising 22000km of arterial roads valued at A$15bn (USD$10bn).

VicRoads has pursued a number of key themes in the management of the State's roads system.

- *A 'strategy-driven' approach*

  State Government strategies set out priorities for the development and management of the road system as a whole. These strategies are consistent with other State Government policies which aim to make Victoria a better place in which to live, work and conduct business. A hierarchy of roads has been established, with different standards for the development and maintenance of each class of roads in the hierarchy. All projects implemented must conform to the strategy in addition to satisfying other criteria (eg. benefit/ cost, readiness to proceed, public support)

  One strategy for particular note, is the "Stitch in Time" road maintenance strategy. This vital strategy has resulted in an increased and regular Government funding commitment to ensure that the long term maintenance needs of the road network are met.

- *Corporate Planning*

  VicRoads has a comprehensive, performance-based planning framework. The Framework below (Fig. 8) shows the relationship of VicRoads 3 year Corporate plan to Government strategies, internal business plans, staff members' key result areas and feedback through performance monitoring.

  In addition to its corporate plan, VicRoads has also identified a number of additional initiatives that will address longer-term trends and help position it for the future.

- *Core businesses*

  VicRoads has defined four core businesses, namely Road System Management, Traffic and Road Use Management, Road Safety and Registration and Licensing. Each core business General Manager is responsible for the development of recommended corporate policies, strategies and programs in his or her area of responsibility.

  This approach ensures a clear focus and a program 'champion' in each of the areas key to VicRoads business.

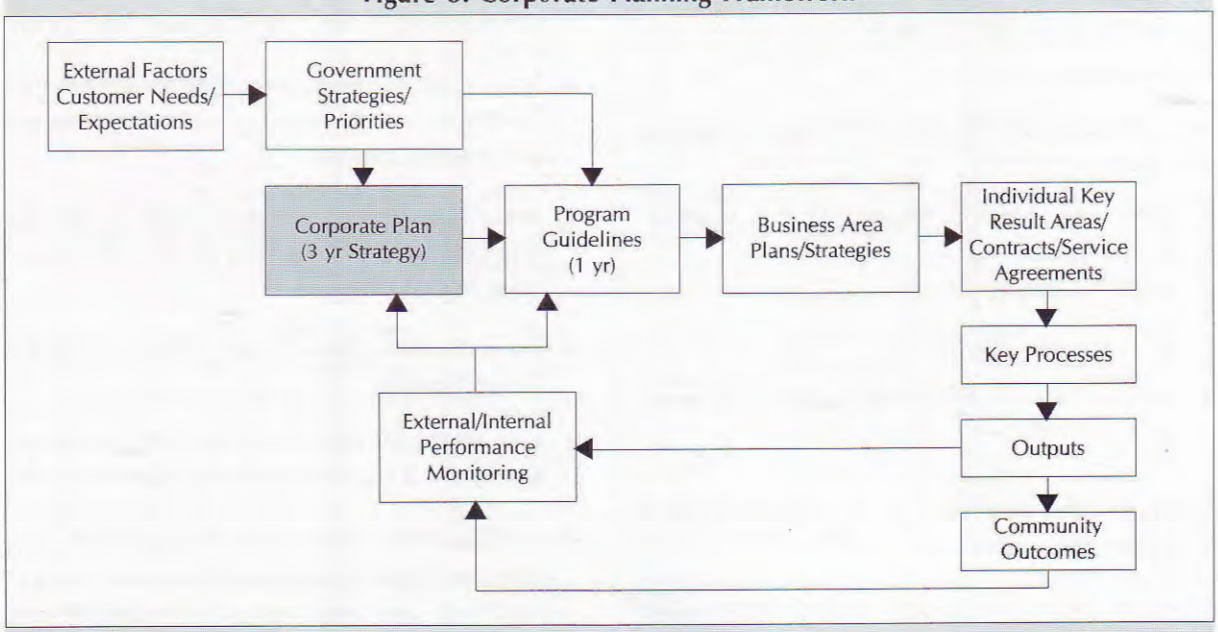
- *Support for National directions and bodies*

  The Victorian State Government is keen to enhance the State's competitiveness by reducing the costs of doing business. Victoria has therefore been at the forefront of national reforms designed to enhance productivity in the road transport industry.

- *Integrated Planning of Transport and Land Use*

  In 1996, the Victorian Government established the Department of Infrastructure to co-ordinate the State's transport and land use planning and development of major infrastructure.

Figure 8: Corporate Planning Framework



The Department has developed integrated Transport strategies for metropolitan Melbourne and rural Victoria.

VicRoads now contributes its skills to the integrated planning and project management of projects outside its previous scope. These include projects involving the provision of railway and tramway infrastructure

- *Customer Focus*

  Stakeholder involvement ranging from the development of recommended strategy to the implementation of projects is a fundamental component of VicRoads approach to the conduct of its business.

  VicRoads has a regionally-based service delivery network, with two regions in metropolitan Melbourne and five regions in rural Victoria. The regions perform important roles in stakeholder liaison, detailed program development and in managing program delivery. They propose detailed program bids in accordance with business planning guidelines set down by the Core Business General Managers.

- *Commercially driven service provision*

  VicRoads has for a long period of time contracted out a proportion of its programs as it made good business sense to utilise the disciplines of competitive forces to obtain increased value for money. Over the past few years, VicRoads has continued on the path of increasing its commercial approach to managing its business. This process was accelerated following the election in 1992 of a State Government committed to a path of wide-ranging economic reform, and aiming to restore Victoria's credit rating to AAA after the State had suffered a number of adverse economic shocks.

  All major road construction is now contracted out. VicRoads has outsourced increasing proportions of road maintenance, as well as other services including information technology, plant hire, legal services and property management. Service contracts are generally three to five years. In areas where VicRoads is the dominant purchaser in the market (eg. Highway linemarking) contracts have been structured to ensure that more than one private sector provider gains a contract to ensure maintenance of a competitive market.

  VicRoads has retained internal service providers in the areas of design, land information and survey, materials technology, information services and road surfacing. These services have been retained to ensure retention and development of core skills or to ameliorate imperfections in external markets. These services are managed commercially, charging purchaser areas for their services and being required to achieve rate of return targets. The provision of these services must conform to State Government competitive neutrality policies.

  More generally, VicRoads now has an output driven focus in its relationship with Government. Key performance indicators and targets are published in the State budget papers. VicRoads, is now funded when it delivers agreed outputs.

- *Development of people and systems*

  As VicRoads moves increasingly to the role of system manager, and as technologies change the nature of its business, particularly in the area of Electronic Service Delivery the skills of its people and its systems need to change.

  VicRoads'services are increasingly becoming available anywhere, anytime, and it is becoming the manager of an information infrastructure suitable for value adding by private sector service providers.

  VicRoads commitment to quality management is demonstrated by its certification corporately to the international quality standard ISO 9002. It has tailored its quality systems to fit with its business improvement strategies rather than simply compiling systems that satisfy each of the requirements for the international quality standard.

  Since gaining ISO 9002 certification, VicRoads has continued to improve its quality systems. Through this approach, it has institutionalised mechanisms to drive continuous improvement of its processes.

Better Roads Victoria Levy

A key initiative of the Victorian State Government has been the introduction in the early 1990's of the "Better Roads Victoria" fuel levy of 3 cents per litre. Under this initiative, the 3 cents per litre collected from motorists is paid into a Trust Fund. Monies from the Fund may only be spent on road improvements approved by the Treasurer and Minister for Roads and Ports. Under the legislation, 1/3 of the funds must be spent on rural road projects and 2/3 on urban road projects. In part, this split seeks to overcome criticisms that there has been over-investment in the rural road network and under investment in the metropolitan road network.

Establishment of Melbourne City Link Authority

In December 1994 the Victorian Government established the Melbourne City Link Authority to oversee the implementation of the A$1.8 billion project known as 'CityLink'.

VicRoads had undertaken the development of the Environment Effects Statement for CityLink, which enabled planning scheme approval to be obtained for the project. The Government decided that, because of the magnitude of the project, that a single purpose authority was required to oversee the project, and the Melbourne CityLink Authority was established. The Government also wanted to utilise private sector financing for the project rather than increase public sector debt, as a key objective for the Government was to regain the State's previously held AAA credit rating.

CityLink involves the construction of new freeway and upgrading of major sections of existing sections of freeway over a 22km length (including tunnels), in a project that links three sections of Melbourne's freeway network that were previously unlinked. It provides a freeway standard bypass of Melbourne's Central Business District and improved freeway access to Melbourne's international airport, international seaport and major interstate railway terminals. CityLink is being implemented under the Build Own Operate Transfer (BOOT) model. The project is a public/private sector partnership, with the private sector developer financing the project's construction, operation and maintenance costs and aiming to recover these costs through tolling collected electronically. The public sector has financed land acquisition costs.

Tolling of vehicles on CityLink is only to be applied either on sections of new freeway or existing freeway sections where those sections have been substantially upgraded. The contractual agreement with the project's developer, Transurban contains certain protections for Transurban designed to protect its investment in the event of changes to Government policy that would adversely affect the project.

It should be noted that CityLink serves purely an arterial road function and not a property access function. Further, as there are alternative lower standard roads available, there is arguably a greater degree of private benefits accruing from the construction of such a road.

CityLink therefore involves the private sector in a much greater role in road management than previously. Transurban, the project developer, will have a direct contractual relationship with motorists who use CityLink. Several hundred thousand motorists will have electronic tags known as "e-tags" to monitor their use on the Freeway. This is the first major application of new technology for road user charging in Victoria.

The State Government has recently announced plans for a further tolled route linking Melbourne's Eastern and Tullamarine Freeways across the north side of Central Melbourne.

Discussion of Road Agency Models

Talvitie (quoted by Cox) has proposed 5 models of road agency development which are summarised as:

1. Bureaucratic
2. Identification of Purchaser/Provider
3. Separation of Purchaser/Provider
4. Corporatisation/ Privatisation of Provider functions
5. Corporatisation / Privatisation of Purchaser functions

In Victoria, we have elements of models 2 and 4.

Separation of purchaser/provider

VicRoads has identified and separated purchaser and provider function, within its organisation consistent with stage 2 of Talvitie's model. Providers such as Design Department, Land Information and Survey, Materials Technology (Geopave) and Bituminous Surfacing (Sprayline) are located within the Commercial Services Divisional Structure. Providers earn income through the supply of services to purchasers within the organisation and to a limited extent, external purchasers.

Corporatisation/Privatisation of Service Delivery

VicRoads contracts with private sector providers all major road construction work, and over 70% of road maintenance, including both routine and periodic maintenance. It also has private sector contracts for a range of other services including plant hire, linemarking, information technology and legal services. The use of design and construct contracts for the large scale projects means that private sector design resources are used for these projects.

The State of Victoria has also adopted a variant of this model where the private sector company, Transurban, is responsible for the major part of the financing and for ongoing management and operation of Melbourne's CityLink for a period of 34 years.

In this case the role of Government has been limited to:

- Obtaining environmental clearance
- Selecting the project developer through a competitive bidding process
- Establishing broad standards for the project
- Funding of land acquisition
- Protecting the "public interest" during project construction (eg. Traffic management plans)
- Providing information for revenue collection purposes
- Fulfilling its contractual obligation to the developer.

Abrams et al of the Australian Productivity Commission have proposed an alternative framework of road management models, namely:

1. Traditional Departmental
2. Output-based management
3. Road fund
4. Public utility model

The 'Traditional Departmental' and 'Public Utility' Models of Abrams et al are similar in nature to Talvitie's 'Bureaucratic' and 'Corporatised/Privatised Purchaser' model respectively. A number of Australian road agencies are operating in or moving towards an output based management model. Under this model, road agencies agree with Government to deliver agreed outputs of a certain standard, within cost and time constraints, and are funded to deliver those outputs. These targets are published in the Governments budget papers. Agencies only receive funds if they actually deliver the agreed outputs.

Government, and hence the community as a whole, is the "funder" and specifier of major priorities. In Victoria, long term directions are established in Government strategies. Funding is determined through Government budgetary processes, under which funding is allocated on a yearly basis and indicative funding provided for years 2 and 3. This model establishes clear accountability for the road agency to deliver agreed outputs, and the actual objectives of the road agency are thus clearer.

Other involvement of Government

Besides budgetary processes, the development of new road links in Victoria are subject to Environment Effects Statement processes. Where planning scheme provision does not exist, or where changing standards indicate that an existing reservation requires modification, then statutory processes are required to be observed.

VicRoads is required to submit its planning proposals to an independent panel for evaluation. This independent planning process allows objectors to state their case. The independent panel makes recommendations to the Minister for Planning for decision as to whether to amend the planning scheme. Consequently, Government decision making is required. Government interventions would also be required in any situation where compulsory property acquisition was required.

As mentioned previously, tolling has only been introduced in Victoria as a means of recovering costs of developing new road links or upgrading existing freeway links. Tolling has not been introduced as an explicit demand management measure.

The costs of vehicle registration have also been set at relatively low levels, which would not have significant effect in discouraging vehicle ownership. For the heavier vehicles, registration charges have been set at levels designed to contribute to cost recovery of road wear contributed by these vehicles.

Conclusion

Road management in Australia has evolved to suit the needs of Australia's political, economic and social systems.

Competitive forces have been harnessed for many years in service provision. This process has proceeded at a faster rate when driven by political and economic imperatives. This has led to increased private sector involvement in road management.

The need for enhancements in national economic performance has led to a vastly increased focus on national approaches to meet the needs of national road transport and export industries. This has led to the establishment of uniform national standards, and recognition of the need for enhanced standard in areas such as mass and dimension limits and safety standards.

Road agencies are part of a wider system of government involved in integrated approaches to land use and transport planning. Government road funding must compete with other priorities of Government such as national defence, health, social welfare, education and law enforcement.

In recent years, access to major sources of private capital has enabled the development of major road infrastructure providing significant enhancements in level of service, which has been beyond the willingness of Government to invest.

Australian Governments and road agencies will continue to evolve road management approaches to meet the needs of the community.

References

1. Abrams, B., Cribbett, P. & Gunasekera, D. *A Comparison of Institutional Arrangements for Road Provision*, Staff Research Paper, Productivity Commission, Ausinfo, Canberra, Australia, 1998

2. Anderson, W. K., *Roads for the People*, Hyland House, South Melbourne, Victoria, Australia 1994

3. Austroads, *Road Facts ' 96*, Sydney, Australia 1997

4. Austroads, *The Australian Road System: Role, Outcomes and Performance Measures*, Sydney, Australia, 1994.

5. Cox, J. B. *Roads in the Community Part I - Are they doing their Job?*, Austroads, Sydney, Australia, 1997

6. Cox, J. B. *Australia's Investment in and Management of Roads – An International Perspective* (unpublished presentation)

7. Department of Premier and Cabinet, Victoria, *Competition Policy*, Melbourne, Australia, 1995

8. VicRoads, *Corporate Plan 1998-2000*, Melbourne, Australia, 1998

Setting Objectives for Road System Performance and Analysing How to Measure Them

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Introduction

Why measure performance? There can be no improvement in a system until there is acceptance that something is wrong. By regularly measuring their performance road administrations can compare their achievements against others, identify where improvement is needed and assess the effectiveness of the changes they make.

Systematic performance measurement is a relatively recent development among public road administrations. This paper describes two systems that have evolved; both indeed are still evolving.

The following attachments provide further detail on the performance indicator frameworks and associated indicators developed for Australia by Austroads and for international use by the Organisation for Economic Co-operation and Development.

Australian Performance Indicators

Attachment 1 sets out a role statement for the Australian road system which aims to provide road managers with a common purpose, thus giving focus to planning and resource allocation activities, while leaving scope for differing priorities and objectives among regions and agencies.

Attachment 2 sets out a statement of outcomes required of the Australian road system in two parts. Part 1 comprises a preamble and national policy requirements. Part 2 comprises the principal outcomes required by key stakeholders.

Austroads consulted with a range of key stakeholders and its member authorities in developing the Role Statement and Statement of Outcomes. The role statement and, more particularly, the Statement of Outcomes, provide the foundation for the development of the Austroads indicators. In a sense, the Role statement and Statement of Outcomes represent a strategic plan for the Australian road system.

Attachment 3 summarises the relationship between the principal outcomes required by stakeholders and the set of indicators developed by Austroads.

The process adopted by Austroads has resulted in a range of indicators addressing some outcomes, while other outcomes do not currently have associated indicators. The process utilised by Austroads to develop indicators includes the prioritisation of outcomes by stakeholders. Consequently, Austroads develops indicators that reflect priority outcomes for stakeholders.

Austroads has had a long term commitment to the development and publication of indicators. Austroads developed its first set of indicators in 1994 and first published them in 1995. Subsequent publications have included increasing numbers of indicators as indicator methodologies have been progressively developed. The original Austroads set has been expanded subsequently to encompass additional social and environmental indicators. The first of these additional indicators is expected to be published in 2000.

Austroads is currently undertaking the early phases of a project to develop additional indicators in the areas of road-based public transport and intermodal freight, reflecting Austroads new role as a modal advice body to the Australian Transport Council.

International (OECD/PIARC) Performance Indicators

Attachment 4 sets out a full set of indicators for road agencies developed by the OECD IR7 Scientific Expert Working Group. These indicators have been developed within a very different conceptual framework to that used by Austroads. However, there are similarities in the outcome areas addressed by the AUSTROADS and OECD Frameworks.

The OECD IR7 Scientific Expert Working Group has proceeded with a field trial of sixteen indicators. (shown underlined in Table 4). The OECD is expected to report the results of the indicators collected in the field trial later in 1999.

Comparison and Contrast of AUSTROADS and OECD Performance Indicators

The AUSTROADS Indicators address a range of outcomes of the use of the road system in a numeric

manner, for example, travel times, safety, environment. AUSTROADS indicators also address performance of road agencies for a range of efficacy issues (for example, benefit cost of road programs) and efficiency issues (for example, User Transaction Efficiency). The AUSTROADS indicators, which are reported annually, enable comparison of performance between jurisdictions and also within a jurisdiction over time. They therefore act as 'triggers' to make further examination of the reasons for differences in performance. They are also capable of being used as target objectives.

The OECD Indicators have a much larger focus on process issues (for example, processes in place for long term construction and maintenance, management systems for the distribution of resources). The OECD approach focuses more on comparing agencies in terms of systems and processes in place, rather than the numerical results obtained.

In one sense, the AUSTROADS and OECD approaches are complementary. For example, in Australia, when we wish to examine differences in performance, we need to investigate the processes, which led to those differences.

Both approaches have applicability in road management in helping to drive strategy and performance improvement.

References

1. Austroads *The Australian Road System: Role, Outcomes and Performance Measures*, Sydney, Australia, 1994.

2. Cox, J. B., *Review of National Performance Indicators*, 1999 (unpublished draft)

3. Lemlin, M, *Development of Tools for Performance Measurement*, Permanent International Association of Road Congresses, Paris, France, 1998

4. Ministry of Transport and Communication, Finland, *Indicators for General Objectives of the Transport System*, Helsinhi, Finland, 1999

5. Organisation for Economic Cooperation and Development, *Performance Indicators for the Road Sector*, Paris, France, 1997

6. Stuart Management Group Pty. Ltd., *Austroads Additional Social and Environmental Performance Indicators Project*, Sydney, Australia, 1996.

Attachment 1

Role Statement – The Australian Road System

Preamble

The Australian Road System is constituted by the road network, the vehicles, drivers, pedestrians and other users, and the vehicle loadings of passengers and freight.

The road system is an integral part of Australia's Transport System, and as such plays a significant part in achieving effective land use and regional development and contributing to the overall performance of the economy and the social functioning of the community.

The community requires that, along with other elements of the nation's infrastructure, the road system be provided and operated in a manner compatible with achieving the nation's economic, social, defence and environmental goals.

Principal Role

In contributing to these goals, the PRINCIPAL ROLE OF THE ROAD SYSTEM is:

"to facilitate interaction between people and the exchange of goods and services, by providing effective, equitable, land-based accessibility to a wide range of places, and by enabling safe, reliable mobility of people and transport of goods with the efficiency requires to compete in the global economy".

Attachment 2

Table 1
Statement of Outcomes Required of the Road System (As Revised)

Part 1 Preamble – The National Policy Context

The Community requires that the road system be provided and operated so as to achieve the nation's economic, social and environmental goals.

From this has developed a number of broad policy objectives, which together constitute the national policy context within which to determine outcomes and performance of the road system.

These national policy requirements are that the road system be planned, provided and managed so as to achieve:

(i) Integration with the other transport systems of the nation.

(ii) Integration with land-use planning and regional development priorities and objectives.

(iii) Compatibility with government policies and programs for micro-economic reform of infrastructure

systems – to meet world best practice standards necessary to underpin the international competitiveness of Australia's industries – doubly essential in view of the fact transport is a high proportion of cost structures of various Australian industries, and given that the road network and vehicle components of the road system are capital-intensive against the background that Australia is a capital importing nation which needs to invest its capital funds in high yielding programs and projects.

(iv) Contribution to environmental goals of reducing consumption of resources and outputs of pollutants; there is a growing awareness of the need for more ecologically sustainable and less polluting transport and land use systems in Australia, which may require some restriction on mobility in the road system.

(v) Contributing towards meeting social goals in terms of providing access to economic and social opportunities. This includes meeting an appropriate level of access for isolated and remote communities and for the transport disadvantaged generally.

Part 2 The Australian Road System
Principal Outcomes Required By Key Stakeholders

Economic Outcomes

(i) Lower road user resource costs (eg. Vehicle operating costs and travel times)

(ii) Lower non-road costs of road users, by strategic road interventions assisting efficient location choices and minimisation of inventories, and by harmonisation of transport (and other) regulations, across state borders.

(iii) Increased regional development, including tourism, mining, agriculture, growth of regional centres and urban development, by new and improved roads enhancing accessibility and reducing travel costs.

(iv) Expansion of the scope of markets, by bringing them closer together in time and cost through new and improved roads.

(v) Economic based choices of transport vehicles, modes, routes and times of use, by matching social costs of use to prices charged to users.

Social Outcomes

(vi) A basic level of accessibility to other places and activities for all communities throughout Australia, in concert with other transport modes, providing for health and education services and enhanced employment opportunities particularly in remote areas.

(vii) Wider range of choices and opportunities for interaction among people, organisation and businesses, by improved accessibility and mobility.

(viii) Fair distribution of costs and benefits of the road system.

Environmental Outcomes

(ix) More environmentally sustainable road transport in terms of resource consumption.

(x) Lower levels of gaseous and noise emissions and minimum impacts upon the amenity of the built environment.

(xi) The risks to systems of ecological significance and bio-diversity are minimised through the improved development, maintenance and operation of the road system.

Safety Outcomes

(vi) Lower levels of road-related deaths, injuries and costs, by reduction in the incidence and severity of road accidents.

(vii) Safe transport of hazardous loads.

Attachment 3

THE AUSTRALIAN ROAD SYSTEM PRINCIPAL OUTCOMES REQUIRED BY KEY STAKEHOLDERS	PERFORMANCE INDICATORS	
	Road System	**Road Authorities**
Economic Outcomes (i) Lower road user resource costs	Actual Travel Time Nominal Travel Time Congestion Indicator User Satisfaction Index User Costs/Distance Travelled Variability of Travel Exposure Smooth Travel Exposure	Road Maintenance Effectiveness Return on Construction Expenditure Return on Maintenance Expenditure* Road Construction Cost + Achievement Index
(ii) Lower non-road costs of road users, by strategic interventions assisting efficient location choices and minimisation of inventories, and by harmonisation of transport (and other) regulations, across state borders		User Transaction Efficiency User Transaction Additional User Transaction Additional Costs

THE AUSTRALIAN ROAD SYSTEM PRINCIPAL OUTCOMES REQUIRED BY KEY STAKEHOLDERS	PERFORMANCE INDICATORS	
	Road System	**Road Authorities**
(iii) Increased regional development,including tourism, mining,agriculture, growth or regional centres and urban development, by new and improved roads enhancing accessibility and reducing travel costs	No measures yet poposed	No measures yet proposed
(iv) Expansion of the scope of markets, by bringing them closer together in time and cost through new and improved roads.	No measures yet proposed	No measures yet proposed
(v) Economic based choices of transport vehicles, modes, routes and times of use, by matching social costs of use to prices charged to users.	Lane Occupancy Rate Proportion of Travel on Primary Roads+	Efficient Charging+
Social Outcomes (vi) A basic level of accessibility to other places and activities for all communities throughout Australia, in concert with other modes,providing for health and education services and enhanced employment opportunities particularly in remote areas.	Accessibility Index – Rural/Remote Region* Accessibility to Public Transport* Equity of Urban Access*	No measures yet proposed
(vii) Wider range of choices and opportunities for interaction among people, organisations and business, by improved accessibility and mobility.	No measures yet proposed	No measures yet proposed
(viii) Fair distribution of costs and benefits of the road system	Extent of externalities Recovery	No measures yet proposed
Safety Outcomes (ix) Lower levels of road-related deaths, injuries and costs, by reductions in the incidence and severity of road accident	Social cost of Casualty Crashes per head of Population Social cost of Casualty Crashes per Vehicle-km Travelled Casualty Crashes per head of Population Casualty Crashes per Vehicle-km Travelled Road Fatalities per head of Population Road Fatalities per vehicle-km Travelled Persons Hospitalised per head of Population Persons hospitalised per Vehicle-km Travelled	Return on Safety Expenditure*
(x) Safe transport of hazardous loads	No measures yet proposed	No measures yet proposed
Environmental Outcomes (xi) More environmentally sustainable road transport in terms of resource consumption	Total Demand for Transport* Total Freight Demand* Vehicle Fuel Efficiency*	No measures yet proposed
(xii) Lower levels of gaseous and noise emissions and minimum impacts upon the amenity of the built environment	Greenhouse gas emissions Traffic Noise Exposure	No measures yet proposed
(xiii) The risks to systems of ecological significance and bio-diversity are minimised through the improved development, maintenance and operation of the road system.		Resource Recycling and Substitution* Roadside Quality Maintenance*

* *Indicator under development*

\+ *Indicator suspended/abandoned*

OECD (IR7 SCIENTIFIC EXPERT GROUP) PERFORMANCE INDICATORS FOR THE ROAD SYSTEM

PERSPECTIVE COMPONENT	GOVERNMENT (MINISTRY)	ROAD ADMINISTRATION	ROAD
Accessibility Mobility Note: Many of these measurea also apply in Equity, Community, and Economic Development categories	– **HCM Level of service (%): A, B, C, D, E** – Ditto by functional class – **Average user cost/ veh/km (car and truck** – **Total transport cost/GNP**	– **Expenditures for maintenance + operational/veh.km or Equivalent Standard Axle load (ESAL)** – Ditto by functional class – **Travel time** – **Std dev of travel time** – Quality of infrormation to road users (from audit) – Hours of congestion delay	– **Level of satisfaction regarding travel time, its reliability and quality of information (by road) user groups based on market studies** – **Average user cost per veh-km** – Composite access index
Safety	– **Accident risk: fatalities and injury accidents per vehicle -km (and the number of fatalities and injured)** – **Percentage of accidents involving drunken drivers** – Percentage of population that considers traffic injuries as a public health problem	– **Percentage of traffic-flow speeding** – Percent of roads not meeting minimum design – Exposure of pedestrians and cyclists to vehicle traffic – Safety pograms of traffic flow (Y/N)	– **non-motorised road user risk (pedestrians, cyclists)** – **Time from alert to treatment (medivac)** – Number of fatalities – Number of injured
Environment	– **Quality of the air** – Existence of inspection/ maintenance programme for emission	– **Environmental policy/ programme (Y/N)** – **Use of de-icing salts (kg/km)** – **Emissions/capita of CO_2, NO_{x9}, PM** – Recycling ratio – Quality/Pollution of road runoff water – Use of fine aggregates for ice (kg/m^2)	– **% of population exposed to noise levels > 65 dB** – Ditto for violation of emission standards – % of population contended with the air quality
Equity Note: Other measures also apply	– Regional distribution of roads – Laws in favour of the disabled (Y/N)	– Average travel time by user groups (delay + vehicle cost for car truck)	– Travel cost, travel time and accident risk by user groups
Community	– Processes for public participation	– **Processes in place for market surveys for**	– **Satisfaction with number and types of feedback**

PERSPECTIVE COMPONENT	GOVERNMENT (MINISTRY)	ROAD ADMINISTRATION	ROAD
Note: Other measures also apply	procedures and reconsideration of prior decisions	customer feedback (Y/N)	mechanisms
Programme Development	– Long-term programs for construction, maintenance and operations (Y/N) – B/C analysis of the adopted road programme	– Management Systems for the distribution of all the resources (Y/N) – Quality Management/ Audit programme (Y/N) – B-C analysis of the proposed road programme	– Satisfaction with the programme development process
Programme Delivery	– Sufficiency of maintenance funding (maintenance funds/ value of road assests: deviation from budget needed)	– Forecast values of road costs vs. the actual (%) – Overhead percentage – Cost of routine maintenance/km – Number of staff/km – Direct labour/ contacting	– Satisfaction with the programme delivery – User and administration costs associated with delays due to maintenance (other measures are used)
Programme Performance	– Value of assests (trend) Total road expenditures/GNP – Ditto by functional class – Duties and price of motor-fuel (%) – Road budget by programme (construction, maintenance and operation) – Return on assests – Ex-post value of B/C	– Roughness (by road class) – % Defective bridge deck area – Bearing capacity (ditto) – % load posted bridges – Km of lane, number of hours	– Surface condition: potholes/km, rutting (transverse evenness) – Satisfaction with road condition – Rest areas/100km – Cycle times in winter maintenance by road class – User information system (Y/N)

Source : OECD – Report of the scientific expert group IR7 about the performance indicators for the road sector

Note : Underlined indicators are to be reported in the OECD IR7 Performance Indicator field trial

Development and Evaluation of ITS in Japan

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Introduction

As the subject for my presentation, the secretariat had suggested the topic of Intelligent Transport Systems (ITS) in road management and how to measure the benefits and achievements. But with the permission of the secretariat, I modified the topic to make the report more field oriented rather than theory oriented.

I will start with background information on what we are doing in this field. Then I will provide some examples of ITS. At the end of my presentation, I would like to discuss how we evaluate the cost and benefits of ITS.

Metropolitan Expressway (Figure 1)

The first section of the Tokyo Metropolitan Expressway came into operation in 1964 for the Tokyo Olympic Games. From then on, the network has been extended vigorously, and today the total length reaches 256 kilometers, with a further 46 kilometers under construction. Daily traffic is 1.15 million and daily toll revenue is about 710 million yen.

Twenty five percent (25%) of the capital required for construction and improvement is provided directly from the national and local governments, while the remaining 75 percent is mainly borrowed from treasury investments and loans which originate from national postal bank and national pension funds. The Metropolitan Expressway Public Corporation has about 1400 employees, of whom about 50 percent are engineers.

While the Tokyo Metropolitan Expressway Public Corporation services the metropolitan area, a separate body, the Japan Highway Public Corporation, constructs and operates the inter-city motorway all over the country. A similar highway public corporation services the Osaka area.

The Metropolitan Expressway Public Corporation has to complete the repayment of loans within a maximum time span of 50 years. The Metropolitan Expressway consists of three toll spheres, which are Tokyo, Kanagawa and Saitama. Toll rates are fixed until the next toll rate revision in each toll sphere. For example, rates at present are 700 yen in Tokyo, 500 yen in Kanagawa, and 400 yen in Saitama. Users are charged every time they enter the road. This system may be called a semi-closed system. In contrast, the Japan Highway Public Corporation is adopting a fully closed system where drivers pay the toll when they exit the motorway in proportion to the mileage they have traveled.

For road management, we have many issues to cope with which can be classified into the following five categories:

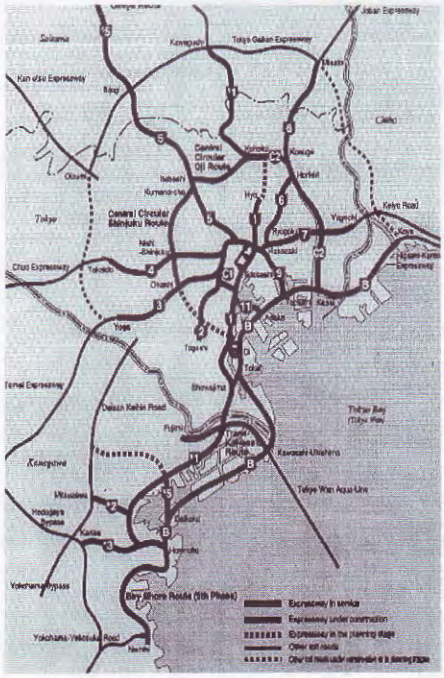
1. Safety and reliability - Although the metropolitan expressway system is ten times safer than ordinary roads, we had about 13,000 accidents and 28 fatalities in 1998. Of these accidents, 47% were rear end collisions, many of them resulting in fatalities.

2. Quick and accurate information distribution - The road is exclusively used by those who have paid toll and they are demanding more traffic information, such as the location of traffic jams, travel times, or better alternative routes.

3. Congestion alleviation - The goal is to maximize the effect of road use with minimum congestion. ITS will be imperative to achieve this optimization.

4. Improvement of the roadside environment - A few years ago, court action was initiated by the residents of Kawasaki in Kanagawa Prefecture on the grounds that traffic noise and air pollution caused by road traffic contravened environment regulations and was hazardous to their health. This court action was settled and reconciliation between the residents and the road administrators was made in May this year. The road administrators promised to take various counter-measures including a kind of traffic volume control, road improvement and installation of noise reduction fences.

Figure 1: Metropolitan Expressway Network



Corporation mainly takes care of inter-city motorways, while the Metropolitan Expressway Public Corporation services the Tokyo metropolitan area.

total length in service : 256 km

total length under construction : 46 km

traffic on the expressways : 1.15 M Vehicles/day (≈ 2 M Users/day)

Metropolitan Expressway Public Corpor

5. Better road management - Of course proper asset maintenance and reduction of costs are major concerns of highway administrations.

Examples of ITS Applications

I would like to refer to the national ITS development scheme briefly. The five ministers' liaison conference was set up in 1995 for the development of ITS in Japan. According to the national comprehensive plan for ITS, the development comprises nine areas:

- Advances in Navigation Systems
- Electronic Toll Collection Systems
- Assistance for Safe Driving
- Optimization of Traffic Management
- Increasing Efficiency in Road Management
- Support for Public Transport
- Support for Commercial Vehicles
- Support for Pedestrians
- Support for Emergency Vehicle Operations

One of the most promising systems in the current development effort is an advanced road system named 'Smartway.' This will result in semi-automated traffic flow within a few years.

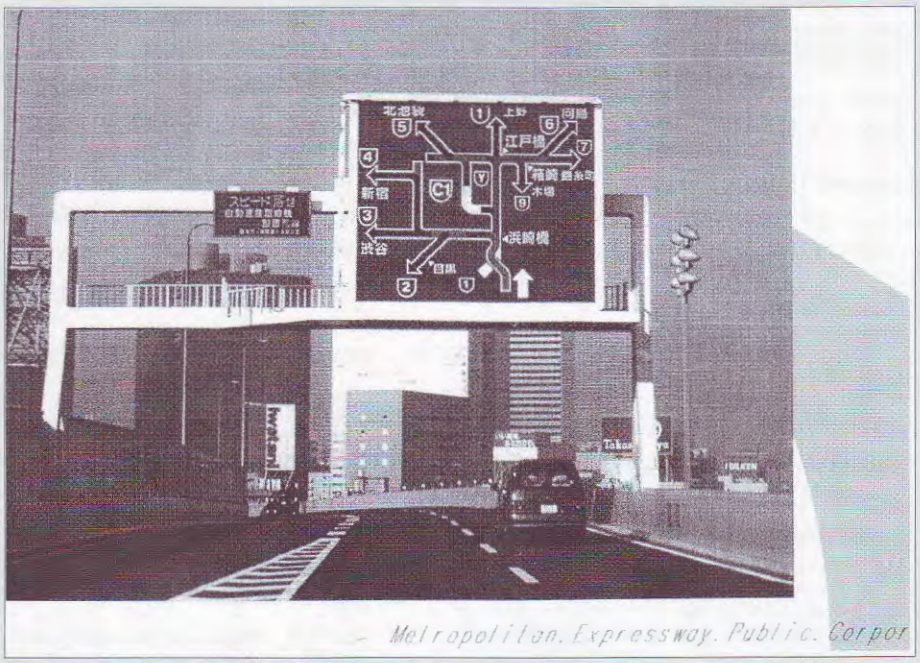
However, we are already reaping the benefits of our research and investment. For example, there is our advanced traffic control system for expressways in Japan. The system comprises three elements: data collection, processing and distribution. Traffic detectors are installed every 300 meters to collect accurate data for travel time and congested sections. 'Travel time' and 'alternative routes' information is updated every single minute. We have presently three traffic control centers, two in Tokyo and one in Kanagawa. For the most part, information is transmitted to users via LED information boards.

One of the most popular types of information is predicted travel time to the destination. The LED information board typically shows the predicted travel time for two alternative routes. Predictably, most drivers who see this board will take the quicker route. This situation will last until the first route becomes more congested and the advantage disappears (Figure 2).

The congestion warning board is a new type of information board. In order to eliminate rear-end collisions, which account for about 50% of fatalities, the board warns that a queue is located some distance ahead, based on the data from detectors on the road. This type of board has brought about a 26% reduction of injury and death from rear-end collisions so far.

So called 'Mex-i robots' are also a useful traffic information tool. They have been installed at all 19 parking areas along the metropolitan expressways, where users can get more detailed information on traffic congestion and travel time by operating a keyboard. The same information will be available through the internet in the future.

Figure 2: Information Distribution Equipment
Graphic Information Board



Of course, conventional radio service using coaxial leakage cable is also available. This tool is able to provide more information than the LED information board. We are also providing two types of telephone service; one is by automatic tape and the other is by manual operation.

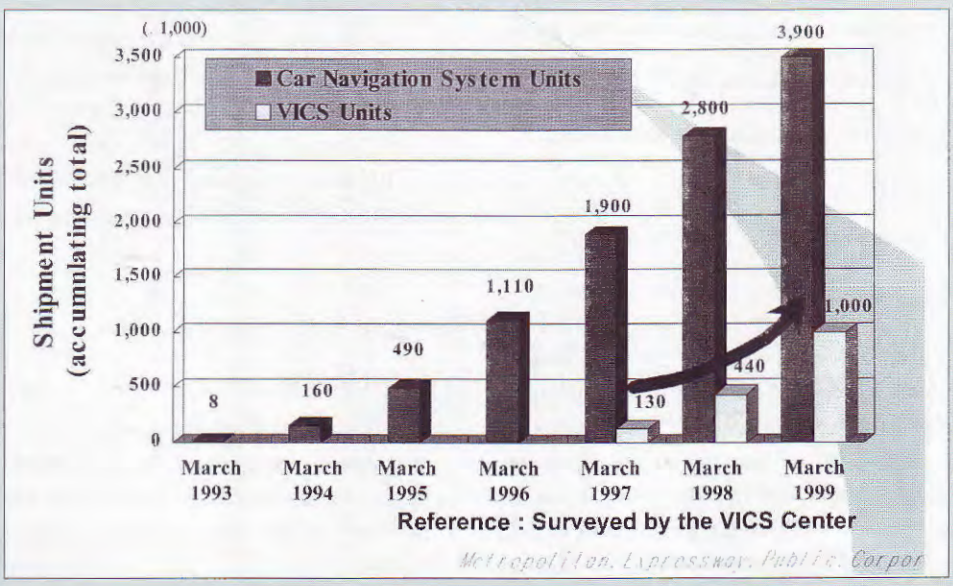
VICS (Vehicle Information and Communication System) (Figure 3)

VICS, an advanced navigation system, is a successful example of ITS. Data from a wide range of sources is conveyed to the traffic information center, processed by the VICS center, and then provided by road authorities and FM radio stations to the users.

All the VICS information is designed to be displayed on a vehicle on-board system. The driver can determine travel time to selected destinations, assess central traffic congestion on the expressways, and assess congestion on the wider road network.

The in-car navigation system is the basic tool of VICS. As of the end of March 1999, the accumulated total of in-car navigation units was about 4 million and the

Figure 3: Transition of Car Navigation System and VICS Units



number linked to VICS was about 1 million. The growth in VICS units has been very rapid, almost trebling in 12 months.

Electronic Toll Collection (ETC)

Congestion at toll gates is the cause for about 30 percent of all congestion in the case of the Japan Highway Public Corporation (less so for the Metropolitan Expressway Public Corporation). This is a compelling reason to move as quickly as possible to automated toll collection.

Procurement of ETC devices began in March 1999. Service will be launched at selected tollgates within the Tokyo metropolitan area by March 2000, not only on Metropolitan expressway but also on the Japan highway network. The system adopts the 5.8 gigahertz active method which promises high reliability. The system is planned and designed to be a national standard for common use throughout Japan. It also aims at multi-application such as provision of traffic information by making use of its communication capability in the future. Specifications are open to all the manufacturers and we are expecting the built-in type on-board unit will appear soon and be made popular in the near future.

The system can handle about four times as many cars as a manual tollgate, which will eliminate long queues and minimize congestion.

Evaluating ITS

Let me start from the justification or the reasons for the introduction of ITS in general. As I outlined earlier, there are five major issues of road management and ITS is one of the countermeasures to cope with these issues:

- safety and reliability in travel time;
- provision of quick and accurate information;
- smooth traffic;
- better environment;
- better road management.

Until recently, cost benefit analysis has not been a prerequisite for ITS applications. Decision making is usually derived from, so to speak, qualitative value for money. Regarding ETC, a late arrival on the scene, some quantitative cost benefit analysis has been carried out and consideration was given to the repayment plan in our organization. I will refer to this later. Let me discuss some examples of evaluation of ITS which was more or less taken into account on the budgetary allocation.

- The traffic control system. As this system has been installed successively with continuous refinement, we have no clear-cut way to evaluate its effect. In empirical terms, I can report that the annual system maintenance cost (assuming a 10 year life for the traffic control system) is about 4% of toll revenue and also about 4% of the annualized investment. This is not, of course, an evaluation, but simply an indication of relative cost.

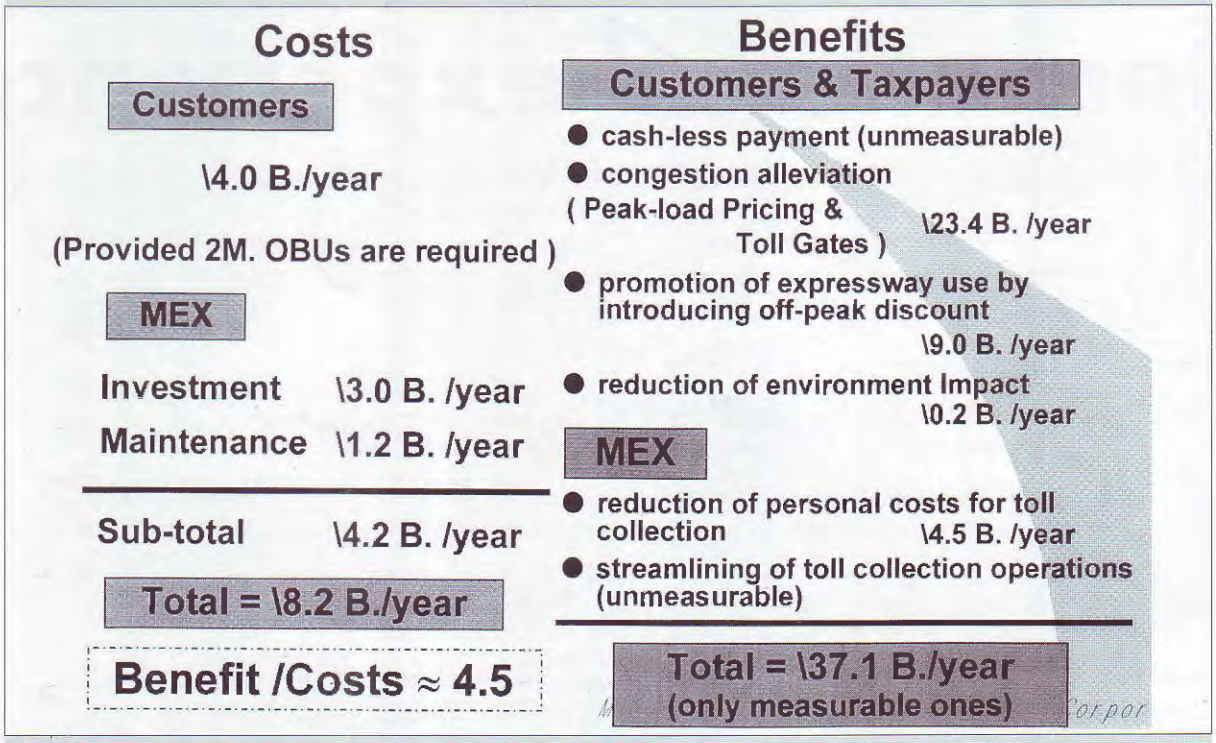
- For VICS, a rough estimate of economic impact has been made. The total costs, comprising investment for the VICS center, information collection and provision devices prepared by road administrators and police, and also information receiving devices, comes to 1200 billion yen for 20 years. The benefit, including travel time reduction and fuel savings, is expected to be 7750 billion yen. So the B/C ratio is 6.5. Other benefits such as mental satisfaction are not taken into account.

- Regarding ETC, the prevalence ratio (the ratio of on-board unit ownership), is crucial for the success of ETC (Figure 4). Because of ambitious adoption of new systems such as TDM (Transportation Demand Management) and off-peak discounts, the total benefit is large enough to accrue a benefit cost ratio as high as 4.5. As far as the Metropolitan Expressway's financial analysis is concerned, the benefit is mainly derived from reduction of personnel costs for toll collection and that is slightly larger than initial cost and maintenance cost. Because of the unique toll collection system of expressways, which utilizes flat toll and on-ramp payment, we do not have long queues at tollgates. The introduction of ETC is based on the common national program led by five ministers concerned and the benefits are greater for, say, the Japan Highway Public Corporation. The major purpose is to provide better service and convenience for the toll road users, while the financial analysis is a kind of supplemental indicator for highway administrators.

Conclusion

ITS is a useful and essential tool to maximize efficiency, safety, comfort and better environment of the road network. In addition, the people who pay to use the Metropolitan Expressway expect a higher level of service. Traffic control systems,

Figure 4: Costs & Benefits of ETC (assuming prevalence ratio of 100%)



ETC and other ITS applications are crucial elements in realizing these goals.

So far, the financial analysis of ITS has not been the focus of attention because of its relative insignificance in contrast to the large amount of civil work being done, and also the urgent need for a higher level of service from demanding toll road users. Also, some ITS projects, like ETC investment, is decided at the national level and national level economic analysis shows the large benefit as high as 4.5.

As I referred to at the beginning, the Japanese government looks upon ITS as one of the strategic fields for technological development and launched a comprehensive plan for development. The Metropolitan Expressway is in a position to support that development as one of major road administrators. As a toll road operator, we should also be more cost conscious.

Technologies which we are interested in are practical fields such as warning of traffic safety or provision of more accurate information. The reduction of maintenance costs is also our major concern.

Finally, quantitative evaluation of the impact of ITS has just started and international collaboration is also an important issue for those who are involved in road management.